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EXAMINER	
WONG, LESLIE	
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2177	5

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Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 10/03)

Office Action Summary	Application No. 10/056,880	Applicant(s) MILBY, GREGORY H.	
	Examiner Leslie Wong	Art Unit 2177	

-- *The MAILING DATE of this communication appears on the cover sheet with the correspondence address* --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *26 October 2001*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-24* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☐ Claim(s) _____ is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *4/27Jan2003*.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☐ Other: _____.

DETAILED ACTION

Information Disclosure Statement

1. Applicants' Information Disclosure Statement, filed 27 January 2003, has been received, entered into the record, and considered. See attached form PTO-1449.

Drawings

2. The drawings were received on 28 May 2002. These drawings are acceptable.

Examiner's Remark

4. In claim 18, line 6, claim 19, line 1, and claim 23, line 5, the term "adapted to" is unclear. The limitation recites: **"the optimizer adapted to select a join plan ..."** Based on Applicant's Specification at page 8, paragraph 0043 and page 9, paragraph 0044. Examiner interprets the meaning of the claimed limitation as **"the optimizer for selecting a join plan"** and thereby examines the application according to the given meaning.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been

> **obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.**

6. Claims 1-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Krishna** (U.S. Patent 6,138,111A) in view of **Dessloch** (U.S. Patent 6,338,056B1).

Regarding claim 1, **Krishna** teaches a method of performing a join in a database system comprising:

a). **'receiving a join query containing a selection predicate and a projection'** as a query containing one or more predicates which specify the information that the query should retrieve from the data and select the names (i.e., projection) of all people who live and work in the same city (col. 1, lines 43-57);

b). **'determining a cost associated with applying the function on a first table and a cost associated with applying the function on a second table'** as a new metric, Sigma, is used to calculate the estimated cost of the joined tables R, S, and T by picking a join order having a smallest Sigma among all join orders (col. 3, lines 44-52); and

c). **'selecting a join path based on relative costs of applying the function on the first and second tables'** as Sigma for join order (1) is 80 and Sigma for join order (2) is 560. Consequently, order (1) is preferred over order (2) because joiner order (1) offers an optimal order for the join tables which

consume less time and resources to process the join query (col. 3, lines 52-55 and lines 23-29).

a). **Krishna** does not explicitly teach a step of a join query containing at least one function selected from the group consisting of a selection predicate applied on a *complex attribute*, a projection applied on a complex attribute, and a *user-defined data type* method.

Dessloch, however, teaches **'a join query containing at least one function selected from the group consisting of a selection predicate applied on a complex attribute, a projection applied on a complex attribute, and a user-defined data type method'** as object-relational database which allows relational database systems to store text, images, video, audio, and other non-traditional data types. These databases are extensible in terms of their type system and their query language, thereby allowing the user to create and query new data types of the mentioned contents in the database (col. 2, lines 18-30; col. 5, line 61 – col. 6, line 37). As specified in Applicant's Specification at page 5, paragraph 0029, examples of complex data types include data types defined for storing image data, audio data, video data etc.

It would have been obvious to one of ordinary skill in the data processing art at the time of the invention was made to combine the teachings of the cited references because **Dessloch's** teaching would have allowed **Krishna's** to store

and search for the new types of contents, such as images, video, and audio, based on non-traditional data types by enabling users to add columns of the appropriate data types as suggested by **Dessloch** at col. 6, lines 1-20. Further, complex attribute and user-defined data types as suggested by **Dessloch** improve the performance of the database system because the optimizer will attempt to take advantage of the User Defined Functions (UDFs data filter) and the index exploitation of the UDFs on a join operation for the generation of the optimal plan (col. 17, lines 40-67).

Regarding claim 2, **Krishna** further teaches wherein **'selecting the join path comprises applying the function on one of the first and second tables associated with a lower cost'** as using the Sigma metric, the join order having the smallest Sigma among all join orders is selected as optimal and used to perform the join. Sigma for join order (1) is 80 and Sigma for join order (2) is 560. Order (1) is preferred over order (2) because order (1) offers an optimal order for the join tables. Thus, the cost for processing the joined query using order (1) would be lower than order (2) (col. 3, lines 47-55 and lines 23-29).

Regarding claim 3, **Krishna** further teaches wherein **'determining the costs comprises determining the respective cardinalities of the first and second tables'** as estimating the cost for a join by broken the join orders and obtain the cardinality of each component join in the join order (col. 3, lines 52-64).

Regarding claim 4, **Krishna** further teaches wherein **'determining the cost of applying the function on the second table comprises determining the cost of a join table that is a result of a join of the first table and another table'** as joining tables R and S, and then join the result with table T, resulted in join order 1 which contains the smallest number of records for the total join. The ties among competing join orders may be broken using some other heuristic to perform cost estimate calculations for the selected join order (col. 3, lines 30-65). Joiner order (1) offers an optimal order for the join tables which consume less time and resources to process the join query (col. 3, lines 52-55 and lines 23-29).

Regarding claim 5, **Krishna** further teaches wherein **'selecting the join path comprises applying the function on one of the first and second tables that has the lower cardinality'** as a value for Sigma is calculated by summing each of the cardinality estimates for each component join in the join order and select the join order with the smallest value of Sigma to perform the query (col. 3, line 66 – col. 4, line 7).

Regarding claim 6, **Krishna** further teaches wherein the function comprises a selection predicate applied on a complex attribute of the first table, the join query further containing a projection applied on a complex attribute of the first table, the method further comprising:

a). **'determining a cost associated with applying the projection on the first table and a cost associated with applying the projection on the join table'** as R joins S=20 and ((R join S) join T)=60, then the total number of tuples created during the calculation of the total query is 80. The join order with the smallest Sigma value is selected to perform the join query because it consumes less time and resources to process the query (col. 3, lines 23-42),

b). **'wherein selecting the join path comprises applying the projection on one of the first table and the join table associated with a lower cost'** as join order 1 which contains the smallest number of records for the total join. Thus, offers an optimal join for the tables (col. 3, lines 30-64).

Regarding claim 7, **Krishna** further teaches wherein **'selecting the join path comprises applying the projection on one of the first table and join table with the lower cardinality'** as joining tables R and S, and then join the result with table T, resulted in join order 1 which contains the smallest number of records for the total join (col. 3, lines 30-64).

Regarding claim 8, **Krishna** further teaches wherein '**identifying the function as a costly function'** as calculating the estimated cost for the selected join order (col. 3, lines 44-52).

Regarding claim 9, **Krishna** further teaches wherein **'the receiving, determining, and selecting acts are performed by an optimizer module'** as a

database optimizer may use whatever other method it has available for computing or estimating the selectivity of other kinds of joins (col. 5, lines 32-38).

Regarding claim 10, **Krishna** further teaches wherein **'determining the costs of applying the function on the first and second tables comprises determining the costs of applying the function on relational tables'** as calculating the cardinalities of the selected join order for the tables specified in the join query (col. 3, lines 30-64).

Krishna does not explicitly teach determining the costs of applying the function on *object* relational tables.

Dessloch, however, teaches **'*object* relational tables'** as object-relational database systems provide an architecture and application program interface for integrating content management and search functions for new data types in form of plug-ins (col. 2, lines 18-39).

It would have been obvious to one of ordinary skill in the data processing art at the time of the invention was made to combine the teachings of the cited references because **Dessloch's** teaching would have allowed **Krishna's** to provide database users with new data types and their advanced content search capabilities inside of SQL as suggested by **Dessloch** at col. 2 lines 34-39.

Regarding claim 11, **Krishna** further teaches an article comprising at least one storage medium containing instructions that when executed cause a database system to:

a). **'receiving a join query containing a selection predicate, a projection, and a user-defined data type method'** as a query containing one or more predicates which specify the information that the query should retrieve from the data and select the names (i.e., projection) of all people who live and work in the same city (col. 1, lines 43-57); and

b). **'determine a join path for the join query based at least in part on a cost associated with application of the function'** as a new metric, Sigma, is used to calculate the estimated cost by picking a join order having a smallest Sigma among all join orders (col. 3, lines 44-52).

a). **Krishna** does not explicitly teach a step of a join query containing at least one function selected from the group consisting of a selection predicate applied on a *complex attribute*, a projection applied on a complex attribute, and a *user-defined data type* method.

b). **Krishna** does not explicitly teach the *complex attribute*.

Dessloch, however, teaches **'a join query containing at least one function selected from the group consisting of a selection predicate applied on a complex attribute, a projection applied on a complex attribute, and a user-defined data type method'** as object-relational database which allows relational database systems to store text, images, video, audio, and other non-traditional data types. These database are extensible in terms of their type

system and their query language, thereby allowing the user to create new data types of contents in the database as well as manipulate and search such content (col. 2, lines 18-30; col. 5, line 61 – col. 6, line 37). As specified in Applicant's Specification at page 5, paragraph 0029, examples of complex data types include data types defined for storing image data, audio data, video data etc.

It would have been obvious to one of ordinary skill in the data processing art at the time of the invention was made to combine the teachings of the cited references because **Dessloch's** teaching would have allowed **Krishna's** to store and search for the new types of contents, such as images, video, and audio, based on non-traditional data types by enabling users to add columns of the appropriate data types as suggested by **Dessloch** at col. 6, lines 1-20. Further, complex attribute and user-defined data types as suggested by **Dessloch** improve the performance of the database system because the optimizer will attempt to take advantage of the User-Defined Functions (UDFs data filter) and the index exploitation of the UDFs on a join operation for the generation of the optimal plan (col. 17, lines 40-67).

Regarding claim 12, **Krishna** further teaches wherein **'the join query specifies the function being applied on a first table, and wherein the instructions when executed cause the database system to determine the join path by applying the function on a second table different from the first table'** as optimizing the order in which tables are joined by selecting the join path

which contains the smallest Sigma value to perform the query in a multiple join query (col. 2, lines 5-12; col. 3, lines 44-56).

Regarding claim 13, **Krishna** further teaches wherein **'the second table is a result of a join of the first table and another table'** as a join query in which tables R, S, and T are to be joined. The system joins tables R and S then joins the result of tables R and S with table T (col. 3, lines 30-41).

Regarding claim 14, **Krishna** further teaches wherein **'the join query specifies the function being applied on a first table'** as a query containing one or more predicates which specify the information that the query should retrieve from the data and select the names (i.e., projection) of all people who live and work in the same city (col. 1, lines 43-57), and

wherein **'the instructions when executed cause the database system to determine the join path by applying the function on a second table having a lower cardinality than the first table'** as using the Sigma metric, the join order having the smallest Sigma among all join orders is selected as optimal and used to perform the join. Sigma for join order (1) is 80 and Sigma for join order (2) is 560. Order (1) is preferred over order (2). Estimating the cost for a join by broken the join orders and obtain the cardinality of each component join in the join order and select the join order which has the smallest value of cardinalities to perform the join query (col. 3, lines 52-64) (col. 3, lines 47-55).

Regarding claim 15, **Krishna** further teaches wherein **'the instructions when executed cause the system to determine the join path by applying the function on one of a first table and second table having a lower cardinality'** as a value for Sigma is calculated by summing each of the cardinality estimates for each component join in the join order and select the join order with the smallest value of Sigma to perform the query (col. 3, line 66 – col. 4, line 7).

Regarding claim 16, **Krishna** further teaches wherein **'the second table is a join of the first table and another table'** as a join query in which tables R, S, and T are to be joined. The system joins tables R and S which yields the results of R and S then join the result of tables R and S with table T (col. 3, lines 30-41), and wherein **'the instructions when executed cause the system to determine the join path by further specifying a join of the second table and a third table to produce a fourth table'** and then join the result of tables R and S with table T (col. 3, lines 30-41).

Regarding claim 17, **Krishna** further teaches wherein **'the join query further specifies application of a second function selected from the group consisting a selection predicate and a projection'** as a query containing one or more predicates which specify the information that the query should retrieve from the data and select the names (i.e., projection) of all people who live and work in the same city (col. 1, lines 43-57), **'the second function being applied on a third table, wherein the instructions when executed cause the**

database system to determine the join path by further applying the second function on one of the third table and a fourth table with a lower cardinality, wherein 'the fourth table is a join result of the third table and another table' as a join query in which tables R, S, and T are to be joined. The system join tables R and S which yields the results of R and S then join the result of tables R and S with table T (col. 3, lines 30-41). The value for Sigma is calculated by summing each of the cardinality estimates for each component join in the join order and select the join order with the smallest value of Sigma to perform the query (col. 3, line 66 – col. 4, line 7).

Krishna does not explicitly teach a step of at least one function selected from the group consisting of a selection predicate applied on a *complex attribute*, a projection applied on a complex attribute, and a *user-defined data type* method.

Dessloch, however, teaches **'a selection predicate applied on a complex attribute, a projection applied on a complex attribute, and a user-defined data type method'** as object-relational database which allows relational database systems to store text, images, video, audio, and other non-traditional data types. These database are extensible in terms of their type system and their query language, thereby allowing the user to create new data types of contents in the database as well as manipulate and search such content (col. 2, lines 18-30; col. 5, line 61 – col. 6, line 37).

Regarding claim 18, **Krishna** further teaches a database system comprising:

a). **'a storage system to store tables'** as a mass storage device (Fig. 1, element 16); and

b). **'an optimizer to receiving a join query containing a selection predicate and a projection'** as implementing the methods in query optimizers in relational database management systems. A query containing one or more predicates which specify the information that the query should retrieve from the data and select the names (i.e., projection) of all people who live and work in the same city (col. 1, lines 43-57 and abstract);

c). **'the optimizer adapted to select a join plan based at least in part on a comparison of a first cost of applying the function on a first table and a second cost of applying the function on a second table'** as Sigma for join order (1) is 80 and Sigma for join order (2) is 560. Consequently, order (1) is preferred over order (2) because joiner order (1) offers an optimal order for the join tables which consume less time and resources to process the join query (col. 3, lines 52-55 and lines 23-29).

Krishna does not explicitly teach a step of a join query containing at least one function selected from the group consisting of a selection predicate applied on a *complex attribute*, a projection applied on a complex attribute, and a *user-defined data type* method.

Dessloch, however, teaches **'a join query containing at least one function selected from the group consisting of a selection predicate applied on a complex attribute, a projection applied on a complex attribute, and a user-defined data type method'** as object-relational database which allows relational database systems to store text, images, video, audio, and other non-traditional data types. These database are extensible in terms of their type system and their query language, thereby allowing the user to create new data types of contents in the database as well as manipulate and search such content (col. 2, lines 18-30; col. 5, line 61 – col. 6, line 37). As specified in Applicant's Specification at page 5, paragraph 0029, examples of complex data types include data types defined for storing image data, audio data, video data etc.

It would have been obvious to one of ordinary skill in the data processing art at the time of the invention was made to combine the teachings of the cited references because **Dessloch's** teaching would have allowed **Krishna's** to store and search for the new types of contents, such as images, video, and audio, based on non-traditional data types by enabling users to add columns of the appropriate data types as suggested by **Dessloch** at col. 6, lines 1-20. Further, complex attribute and user-defined data types as suggested by **Dessloch** improve the performance of the database system because the optimizer will attempt to take advantage of the User-Defined functions (UDFs data filter) and the index exploitation of the UDFs on a join operation for the generation of the optimal plan (col. 17, lines 40-67).

Regarding claim 19, **Krishna** further teaches wherein **'the optimizer is adapted to select the join plan that applies the function on the one of the first table and second table with a lower cardinality'** as a value for Sigma is calculated by summing each of the cardinality estimates for each component join in the join order and select the join order with the smallest value of Sigma to perform the query (col. 3, line 66 – col. 4, line 7).

Regarding claim 20, **Krishna** further teaches wherein **'the second table is a join result of the first table and another table'** as a join query in which tables R, S, and T are to be joined. The system joins tables R and S then joins the result of tables R and S with table T (col. 3, lines 30-41).

Regarding claim 21, **Krishna** further teaches wherein **'the join query specifies the function being applied on the first table'** as selecting all columns from table S (i.e. first table) (col. 4, lines 40-41).

Regarding claim 22, **Krishna** further teaches wherein **'the first and second tables are relational tables'** as a general computer platform suitable for supporting a relational database system. A relational database is a database that is perceived by its users as a collection of tables such as tables R, S, and T in Fig. 1 (col. 2, lines 66-67; col. 1, lines 7-9).

Krishna does not explicitly teach "***object*** **relational tables**".

Dessloch, however, teaches **'the first and second tables are *object* relational tables'** as object-relational database systems provide an architecture and application program interface for integrating content management and search functions for new data types in form of plug-ins (col. 2, lines 18-39).

It would have been obvious to one of ordinary skill in the data processing art at the time of the invention was made to combine the teachings of the cited references because **Dessloch's** teaching would have allowed **Krishna's** to provide database users with new data types and their advanced content search capabilities inside of SQL as suggested by **Dessloch** at col. 2 lines 34-39.

Regarding claim 23, **Krishna** further teaches wherein **'the join query further specifies application of a second function selected from the group consisting a selection predicate and a projection'** as a query containing one or more predicates which specify the information that the query should retrieve from the data and select the names (i.e., projection) of all people who live and work in the same city (col. 1, lines 43-57), **'the second function being applied on a third table, wherein the instructions when executed cause the database system to determine the join path by further applying the second function on one of the third table and a fourth table with a lower cardinality, wherein 'the fourth table is a join result of the third table and another table'**

as a join query in which tables R, S, and T are to be joined. Join tables R and S which yields the temp table containing the results of R and S, and then join the result of tables R and S with table T (col. 3, lines 30-41).

Krishna does not explicitly teach a step of a selection predicate applied on a complex attribute, a projection applied on a complex attribute, and a user-defined data type method.

Dessloch, however, teaches **'a selection predicate applied on a complex attribute, a projection applied on a complex attribute, and a user-defined data type method'** as object-relational database which allows relational database systems to store text, images, video, audio, and other non-traditional data types. These database are extensible in terms of their type system and their query language, thereby allowing the user to create new data types of contents in the database as well as manipulate and search such content (col. 2, lines 18-30; col. 5, line 61 – col. 6, line 37).

Regarding claim 24, **Krishna** further teaches wherein '**the tables are relational tables'** as a general computer platform suitable for supporting a relational database system. A relational database is a database that is perceived by its users as a collection of tables such as tables R, S, and T in Fig. 1 (col. 2, lines 66-67; col. 1, lines 7-9).

Krishna does not explicitly teach "***object* relational tables**".

Dessloch, however, teaches **'the tables are *object* relational tables'** as object-relational database systems provide an architecture and application program interface for integrating content management and search functions for new data types in form of plug-ins (col. 2, lines 18-39).

It would have been obvious to one of ordinary skill in the data processing art at the time of the invention was made to combine the teachings of the cited references because **Dessloch's** teaching would have allowed **Krishna's** to provide database users with new data types and their advanced content search capabilities inside of SQL as suggested by **Dessloch** at col. 2 lines 34-39.

Conclusion

7. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

U.S. Patent 5,608,904A issued to Chaudhuri et al on March 04, 1997. The subject matter disclosed therein is pertinent to that of claims 1-24 (e.g. query optimization for multiple predicate, estimate cost, and select path with low cardinality, user-defined data type).

U.S. Patent 6,370,522B1 issued to Agarwal et al. on April 09, 2002. The subject matter disclosed therein is pertinent to that of claims 1, 6, 10, 11, 17, 18,

and 22-24 (e.g., object-relational database, optimizer related functions, calculate cost of execution plans)

U.S. Patent 6,377,943B1 issued to Jakobsson on April 23, 2002. The subject matter disclosed therein is pertinent to that of claims 1-24 (e.g. join ordering, least cost join order).

U.S. Patent 6,341,281B1 issued to MacNicol et al. on January 22, 2002. The subject matter disclosed therein is pertinent to that of claims 1-24 (e.g., optimizing nested queries).

U.S. Patent 5,956,706A issued to Carey et al. on September 21, 1999. The subject matter disclosed therein is pertinent to that of claims 1-24 (e.g., cardinality-limiting operator, optimizer to generate optimal execution plan) .

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Leslie Wong whose telephone number is (703) 305-3018. The examiner can normally be reached on Monday to Friday 9:30am - 6:30 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John E Breene can be reached on (703) 305-9790. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Leslie Wong
Patent Examiner
Art Unit 2177

LW
March 25, 2004